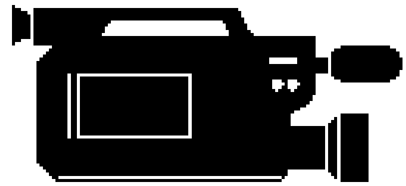
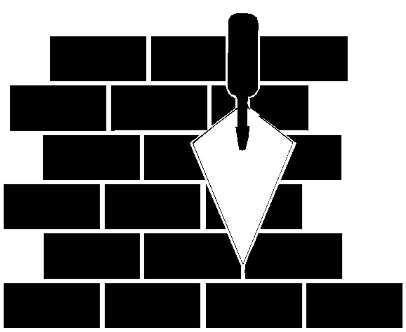
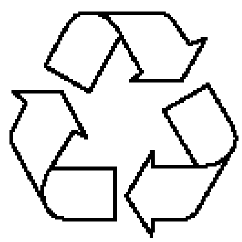


Indiana
Technology Education

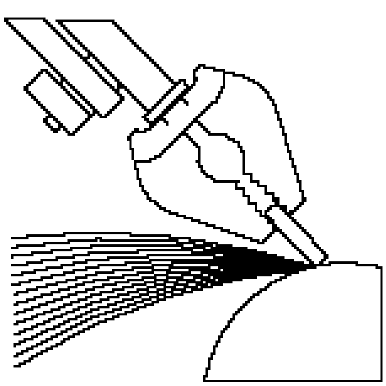
http://www.doe.state.in.us/OCTE/technologyed/welcome.html





Communication Systems

Course Guide for
Secondary School Programs



2005 Edition

Communication Systems Guide – 2005 Edition

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Technology – A Foundation

To many people, technology means cell phones, robots, and computers. They see modern technology as the "stuff" that scares the uninformed and may even threaten them with job displacement. Technology to this group is often described as the hardware that enslaves people. To other people technology is the instrument of environmental destruction. Its improper use pollutes the air we breathe and the water we drink. This group often longs to return to a simpler life; less complicated by technological advancements. To still other people technology is the hope for a more comfortable and efficient life. It can feed the hungry, allow individuals to remain in contact with the entire world, and create shelter for the exploding population. Technology is seen as "the answer" to both immediate and future problems.

To some extent all three views are correct. However, to address what people need to know about technology, the term needs clarification. Technology is the product of the human mind and its engineering spirit. The *Standards for Technological Literacy* document (ITEA 2000) notes that technology involves "the generation of knowledge and processes to develop systems that solve problems and extend human potential". Technology is the result of human volition and control. Therefore, all technology has been developed by people to meet people's needs and wants, and is subject to human monitoring.

Today, technology is in evidence everywhere on our planet. Most of the world is concerned about energy, employment in productive enterprises, adequate resources, and the growing mountain of waste. Transportation, shelter, and entertainment are also common themes in all countries and cultures. An understanding of technological concepts is a must for every citizen of our global society.

To introduce technology to young learners, teachers should start with several basic concepts. First these four statements help summarize the concept of "technology":

- Technology is human knowledge.
- Technology uses tools, materials, and systems.
- Application of technology results in artifacts (human-made things) and other outputs (pollution, scrap, etc.).
- Technology is developed by people to modify or control the natural and human-made environments.

These four points suggest that technology is a unique body of knowledge and is among the academic areas that should form the basis for modern education:

- Scientific knowledge describes the laws and principles that govern the natural world and practices used to discover these laws and principles.

- Technological knowledge describes the human-made world and the practices used to design, produce, and use products, structures and systems.
- Humanities knowledge describes the development and use of cultural values, beliefs, and ethics.
- Descriptive knowledge describes the ways people used signs and symbols (such as the English language or math) to convey information and ideas.

All students need a balance of these four types of knowledge as they progress through grades K-12 (i.e., formal schooling). In addition, students with specific career goals require special emphasis in one or more of these areas.

Education about the practical world is almost as old as humankind. Early experiences were almost totally trade oriented. In the last 100+ years educators have recognized that broad, general (not career specific) education about tools and materials is important. Out of this belief a new program took form as manual training and later industrial arts. However, these subjects drew their content almost totally from the skilled trades and focused on learning “basic skills” and constructing take-home projects.

The discipline of Technology Education has emerged to replace the skill oriented, technical instruction of industrial arts. Today, the educational focus is on technological literacy, or one's ability to use, manage, assess, and understand technology. National content standards for technological literacy, released in April 2000, help identify and clarify this mission.

Technological literacy is gained by having students study the creation, use, and behavior of tools, machinery, materials, and technical means and the behavior of these resources in relation to humans, their societies, and the environment. The typical goals of technology education programs include helping all learners . . . .

- Know and appreciate the importance of technology
- Be able to safely use appropriate tools, materials, processes, and technical concepts
- Apply design and problem-solving techniques
- Be able to assess the influence of technology on people, society, and the environment
- Make wise career and consumer choices
- Better understand the forces that shape the future

To reach these goals, a T.E. program should address the knowledge of technology (or cognitive standards), the action of technology (doing), and the appropriateness of technology (managing and assessing). Often, the focus on specific problems and opportunities relate to major elements in the designed world. Content standards for the study of technology (released April 2000) include these topics:

- ✔ Agricultural and related bio-technologies
- ✔ Construction technology
- ✔ Energy and power technology
- ✔ Information / communication technology
- ✔ Manufacturing technology
- ✔ Medical technology
- ✔ Transportation technology

The majority of the suggested content found in the Standards for Technological Literacy document can be found in the Indiana Technology Education curriculum guides. For instance, multiple courses related to manufacturing and transportation are found in the Indiana program. At the same time, concepts related to agricultural, medical / health, and certain energy topics are highlighted in greater detail in other academic areas in Indiana's schools.

The Indiana Industrial Technology Education curriculum was first developed and implemented in the 1980s. A formal name change also took place in the mid-1990s (removing the term “Industrial” from the title). Program support booklets and the upper–level course guides were revised following the release of the national standards in April 2000. All of these changes have resulted in a new, broader-based curriculum which support the content and benchmarks found in the Standards for Technology Literacy: Content for the Study of Technology (ITEA, 2000).

The present Indiana Technology Education program is based on the following vision for Technology Education in the State of Indiana:

> *All students in Indiana will apply their knowledge in appropriately designing, selecting, and using current and future technologies and in assessing their impacts.*

The foundation of this vision is the view that technology involves applying resources to design, produce, use, and manage products and services that extend the human potential for improving and controlling the natural and human-made environment. The vision statement also communicates that all students regardless of gender, ethnicity, career goals, or abilities can profit from a study of technology. The ultimate goal for all Indiana students is technological literacy.

In addition, this vision statement leads directly to the definition of technology education as a discipline in today's schools. Technology Education is:

> *An action-based program for all students to learn how to design, produce, use, and assess the impacts of products and services that extend the human potential to improve and control the natural and human-made environment.*

This perspective leads to a unique set of fundamental objectives for the Indiana T.E. curriculum. These objectives note that each student who participates in the technology education program will develop an understanding of technology as a system in the global context by developing an ability to . . . .

- Design technological products, services, and systems
- Use tools, machines, materials, and energy to produce products, services, and systems
- Select appropriate technology to solve problems and meet opportunities
- Appropriately use technology to extend human potential to improve our environment
- Assess the impacts of technology on individuals, society, and the environment
- Use appropriate personal and interpersonal skills to participate in a technological society

The definition of technology and the fundamental objectives provide a foundation for a set of technology courses for Indiana schools. Twenty one course titles have been approved by the State Board of Education, a total which includes six Technology Education-related courses in the Project Lead The Way (PLTW) program. Note: Special training is required to implement the PLTW curriculum.

Courses in the Indiana program are divided into different categories:

✔ **Introducing Technology** - A broad middle school / junior high school experience that can be offered over two or three years (depending on the school's schedule). A total of 36 weeks of instruction is included in the guide.

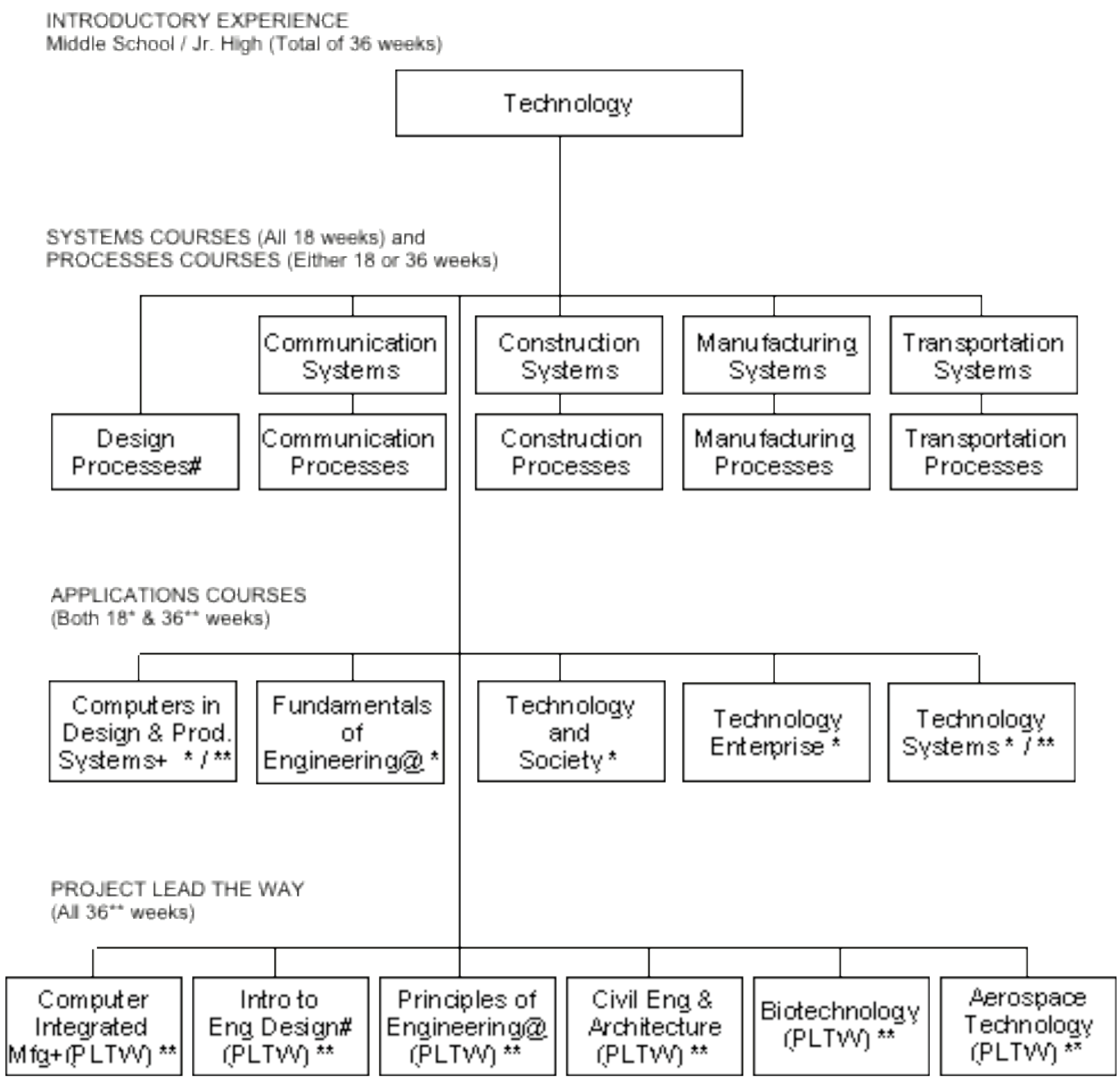
✔ **Technology Systems** - Four high school level courses which present the principles and activities associated with technology in the unique context of communication, construction, manufacturing, and transportation. Each of these classes is one semester in length.

✔ **Technological Processes** - High school courses that focus on the production or the “doing” actions involved in design, communication, construction, manufacturing, and transportation technologies. Students are exposed to more sophisticated content, software, and machinery at this level. Five of these course guides specify both 18 and 36 weeks of instructional experiences.

✔ **Technology Applications** – Includes several specialized technology education courses which are designed to address the unique needs and interests of today's secondary students. Depending on the class, the course guides include 18 and / or 36 weeks of instruction. Note: There is not a separate course guide for the Computers In Design and Production Systems class, as this course title is for locally developed courses.

✔ **Project Lead The Way Program** - Several course titles in the engineering-based PLTW program have been approved for Indiana's secondary schools. These classes cover advanced math, science, and technological content. The course titles are shown in the program model on the next page.

INDIANA TECHNOLOGY EDUCATION CURRICULUM



NOTES: All six Project Lead The Way (PLTW) courses are full year (36 week) experiences. Students may earn credit for either a PLTW course in Design#, Engineering@, and Computers+ or the equivalent Indiana T.E. course, but not both. In addition, PLTW course titles of **Digital Electronics** and **Engineering Design and Development** are approved titles for Indiana schools (and appear under the Multidisciplinary Category of the Indiana Dept. of Education guidelines).

The Instructional System

Each of the courses in the Indiana Technology Education Curriculum was designed to provide a hands-on / minds-on experience for students as they explore the many facets of technology. This guide is part of a carefully designed instructional system. This system includes many important components: Indiana and national content standards, the teacher, the students, a textbook, curriculum guides, lesson plans and evaluation systems, apparatus, instructional media, and activities.

The Teacher

The teacher plays the primary role in the system. This role entails being a curriculum developer. The instructor develops presentations and demonstrations, prepares for discussions, selects activities, and develops the evaluation system. Care should be taken to cover all the major concepts contained in this guide to insure that the coverage of the subject is comprehensive. At all times resist "picking and choosing" only units and activities that are the most interesting, most familiar, or the easiest to implement. However, as long as the suggested content is addressed, you are encouraged to revise or replace activities with your own activities.

As a technical expert, the teacher gives formal presentations, demonstrates the use of equipment, and leads class discussions that reinforce the subject matter. Safety instruction and the implementation of teaching / learning activities are the responsibility of the instructor.

Basically, the teacher is "the" instructional manager. Managers plan, schedule, direct, and control activities. The teacher (perhaps in cooperation with other teachers and the students) plans the instruction by identifying the instructional goals. The activities to help reach these goals are scheduled. Through presentations and activities students are directed through the course content. Finally, the student's work is assessed through various forms of evaluation. Since evaluation instruments should measure success in reaching specific course goals, the instruments used to assess student achievement are best prepared by the teacher of the actual course.

Students

The target population (for this course) are students in the middle school or junior high grades. The students will often work in small groups. Their responsibilities include reading the textbook assignments, doing the worksheets as homework, entering into discussions, and completing the teacher-directed activities. Students are often able and may request to do additional activities.

[CONTINUED]

Technology Textbooks

A textbook should be selected for the course and each student should have one. A textbook contains the body of knowledge about technology. It also includes a description of unique terms and covers complex principles. Illustrations often help content “come to life”. Each student should be expected to use the textbook (and any related media) throughout the course.

Curriculum Guide

The curriculum guide is to be used to help school staff in planning for instruction. The introduction of the guide lays a foundation for technology and technology education, describes the Indiana curriculum, and presents the instructional system for the course with suggestions on how to use it.

The remainder of each curriculum guide describes the instructional units that make up the course. Every unit consists of an introduction, objectives, a suggested calendar, and descriptions for the actual lessons (presentations, content outlines, discussions, and activities) that are outlined in the calendar. Specific content is marked with bullets and check marks (i.e., a “ ● “ or a “ ✔ “) in the guides. Also, note how content is cross–referenced to existing state and national standards.

Instructional Resources

It takes many resources to conduct a successful, efficient technology education program. Apparatus, videotapes, software, etc. are noted throughout the guides, and all of these resources will help contribute to a meaningful course.

Daily Instructional & Evaluation Plan

Planning of daily activities and the implementation of an on–going evaluation system are the teacher's responsibility, and rightfully so. Each teacher should adapt activities and presentations so they help students develop the identified concepts within local conditions. The curriculum guide was designed to help you, the local professional, present a relevant course. The time frame is flexible as many schools have a traditional schedule while other programs have a “block” schedule in their district.

Activities

The real strength of instruction in technology–based programs is the daily use of hands on / minds on activities. Students learn best when they can make “connections” between concepts and actions. Instructional activities, whether in a classroom or laboratory, help young learners about complex systems and devices. It's also “more fun” to learn through doing!

There are hundreds of ways to introduce content in a safe, creative, and interesting manner. The first time you offer a new technology–based class, it's suggested that the activities in the course guides be implemented. Then, based on the rate of success in your program, you might chose to use alternative activities when offering the same course another time. Note: An alternative activity might be preferable based on differences in class size, availability of resources, time, or other factors. Or, sometimes it's nice to just “do something different” in your program.

"Communication Systems" – The Secondary Level Course

Communication technology helps people exchange ideas and information, over short distances and across the globe. Individuals and entire nations can stay in contact with others due to powerful information systems. These same devices and technologies also provide hours of entertainment or recreation. This is a truly amazing age, dominated by digital gadgets and networks.

Naturally, our ability to communicate has changed dramatically over the centuries. Early human communication was based on crude gestures, writing on clay tablets, and cave paintings. As civilization grew, formal languages and illustration techniques were developed. Technical means such as the printing press, screening printing techniques, and eventually electronic media followed. The application of electricity and development of electronic media has opened the world to rapid information exchange. Today satellite links and the Internet spread messages around the world instantaneously.

Information technologies and systems can be described by using a simple model of the communication process that includes these elements:

- Sender: The human or mechanical source of an idea or information.
- Encoder: The device or technique used to format the information for communication
- Transmitter: The device that moves the message from a sender to a receiver
- Channel: The avenue that the transmitter uses to physically move a message (often referred to an the medium)
- Receiver. The device that captures a message at its destination
- Decoder: The device or technique used to make the transmitted message understandable for the receiver
- Storage: A device or technique used to hold a message for later use.
- Retrieval: The techniques used to extract (download, etc.) a coded message from storage

This course is designed to introduce students to the world of modern communication technology through a variety of presentations, discussion, and laboratory activities. Most activities in this course are designed for small group work. This is especially appropriate since communication takes place between two humans or two pieces of equipment. Typically, the media must be prepared (coded) for exchange, received at a distant point, and made understandable to the receiving party or machine.

Textbooks

The following textbooks have been approved by the Indiana Board of Education as appropriate resources for the Communication Systems course (during the Spring 1999 approval cycle):

Johnson, C. (2000). Communication systems. Tinley Park, IL: Goodheart-Willcox Company. ISBN 1-56637-678-5

Sanders, M. (1997). Communication technology: Today and tomorrow. Blacklick, OH: Glencoe / McGraw–Hill. ISBN 0-02-838759-7

Seymour, R., Ritz, J., and Cloughessy, F. (2000). Exploring communication. Tinley Park, IL: Goodheart-Willcox Company. ISBN 1-56637-678-5

Course Objectives

Upon completing this course, each student should be able to:

- Differentiate between human communication and the actions that involve technical means applied to the communication process
- Explain the fundamental elements of communication technology and information systems
- Describe examples of the fundamental elements and interrelationships of the communication process
- Describe the channels, media, signals, and languages used to communicate information, ideas, and emotions
- Explain the common technical means used to share information and ideas
- Design, produce, and deliver messages using various communication media
- Describe the impact of communication systems and information technology on individuals and society

Communication Systems – Suggested Calendar

UNIT	UNIT TITLE AND CONTENT	# OF DAYS
1	Introduction to Communication Technology Exchanging ideas and information Individual versus mass communication The communication process Evolution of communication technologies	10
2	Designing and Assessing Media / Products Media design techniques Graphic layout Evaluating communication media	15
3	Visual (Imaging) Systems Types of photographic systems Image manipulation Formats Output techniques	15
4	Audio Communication Systems Designing audio messages Recording techniques Producing and editing messages	10
5	Graphic Reproduction Systems Planning print media Desktop publishing Screen process printing techniques	15
6	Telecommunication Systems Fundamentals of electronic systems Producing electronic media messages	15
7	Internet-based Communication Designing media for the Internet Producing messages for the WWW Evaluating electronic media	10

Academic Standards

Coursework in the Indiana T.E. program is directly linked to a variety of academic standards. The next few charts illustrate the relationship of this class to state and national guidelines. In preparing these charts, each lesson or activity in the guide was reviewed to determine exactly what students would learn or experience during each unit of instruction. A comparison was made between (a) instructor and student efforts and (b) various approved content standards. For example, an activity where a student designs a tri-fold brochure about satellite communication networks would involve numerous academic areas, engineering and design documentation being two obvious themes. Checkmarks appear on the charts in the appropriate units.

These charts were prepared as if the suggested content and activities outlined (found in this guide) were used throughout the course. If you substitute a lesson or activity, that may add or subtract checkmarks. One suggestion is that instructors routinely update content and select new activities that help address more (rather than fewer) content standards.

Correlation With The Indiana Standards For Technological Literacy*

General Technological Concepts	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Standard 1. Systems model	✘			✘		✘	
Standard 2. Understand technology	✘	✘	✘	✘	✘	✘	✘
Standard 3. Technological contexts	✘	✘	✘	✘	✘	✘	✘
Standard 4. Design / use technology	✘	✘	✘	✘	✘	✘	✘
Standard 5. Identify needs	✘	✘	✘	✘	✘	✘	✘
Standard 6. Create solutions	✘	✘	✘	✘	✘	✘	✘
Standard 7. Evaluate solutions	✘	✘	✘	✘	✘	✘	✘
Designing & Producing Technology	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Standard 8. Specify solutions	✘	✘	✘	✘	✘	✘	✘
Standard 9. Select resources	✘	✘	✘	✘	✘	✘	✘
Standard 10. Select processes	✘	✘	✘	✘	✘	✘	✘
Using & Assessing Technology	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Standard 11. Use systems	✘	✘	✘	✘	✘	✘	✘
Standard 12. Select devices	✘	✘	✘	✘	✘	✘	✘
Standard 13. Operate devices & systems	✘	✘	✘	✘	✘	✘	✘
Standard 14. Repair & service technologies					✘	✘	
Standard 15. Obsolescence	✘					✘	
Standard 16. Impacts of technology	✘	✘	✘	✘	✘	✘	✘
Standard 17. Entrepreneurship	✘				✘	✘	

*NOTE: Refer to the INDIANA T.E. CONTENT STANDARDS BOOKLET for a full explanation of the current Indiana Standards for Technological Literacy.

Correlation With the TFAA (National Technology Content) Standards

Knowing The Nature Of Technology	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
Std. 1. Characteristics & scope of technology	✘	✘	✘	✘	✘	✘	✘
Std. 2. Core concepts of technology	✘	✘	✘	✘	✘	✘	✘
Std. 3. Technological connections	✘	✘	✘	✘	✘	✘	✘
Knowing About Technology & Society	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Std. 4. Societal effects of technology	✘	✘	✘	✘	✘	✘	✘
Std. 5. Technology & the environment							
Std. 6. Role of technology in society	✘	✘	✘	✘	✘	✘	✘
Std. 7. Technology and history	✘		✘	✘	✘	✘	✘
Knowing About Design	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Std. 8. Attributes of design	✘	✘	✘	✘	✘	✘	✘
Std. 9. Engineering design						✘	
Std. 10. R&D, invention & problem solving	✘	✘	✘	✘	✘	✘	
Abilities For A Technological World	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Std. 11. Apply design processes	✘	✘	✘	✘	✘	✘	✘
Std. 12. Use & maintain technology		✘	✘	✘	✘	✘	✘
Std. 13. Impacts of technology	✘	✘	✘	✘	✘	✘	✘
Abilities For The Designed World	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Std. 14. Medical technologies			✘				
Std. 15. Agriculture & biotechnology							
Std. 16. Energy & power technology						✘	
Std. 17. Info & communication technology	✘	✘	✘	✘	✘	✘	✘
Std. 18. Transportion technology							
Std. 19. Manufacturing technology	✘						
Std. 20. Construction technology							

*This is dependent upon the specific lectures, discussions, and activities used in the course.

Helpful resources in regard to content standards and technology-based courses . . .

International Technology Education Association. (2000). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author (Technology For All Americans Project). ISBN 1-887101-02-0

International Technology Education Association. (2004). *Measuring progress: A guide to assessing students for technological literacy: Student assessment, professional development, and program standards*. Reston, VA: Author. ISBN 1-887101-03-9

Pearson, G. & Young, A.T. (eds.). (2002). *Technically speaking: Why all Americans need to know more about technology.* Washington, DC: National Academy Press. ISBN 0-309-08262-5

Wiggins, G. & McTighe, J. (1998). *Understanding by design*. Alexandria, VA: Assoc. for Supervision and Curriculum Development. ISBN 0-87120-313-8

Crosswalks With Indiana Academic Standards (Note: Grade 10 Indicators)

Language Arts Contexts	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Reading	✘	✘	✘	✘	✘	✘	✘
Writing	✘	✘	✘	✘	✘	✘	✘
Listening	✘	✘	✘	✘	✘	✘	✘
Speaking	✘	✘	✘	✘	✘	✘	✘
Mathematics Contexts	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Algebra							
Geometry		✘			✘		
Calculus							
Probability & statistics	✘	✘		✘			✘
Discrete math		✘		✘	✘		
Science Contexts	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
General science	✘		✘	✘	✘	✘	
Earth & space	✘					✘	
Biology			✘				
Chemistry	✘		✘		✘		
Physics				✘		✘	
Environmental Science							
Social Studies Contexts	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
History	✘	✘	✘	✘	✘		
Geography	✘					✘	
Government	✘			✘		✘	✘
Economics	✘	✘	✘		✘	✘	✘
Psychology	✘	✘				✘	
Sociology	✘	✘				✘	✘

Websites that address content standards . . . .

Academic Standards in Indiana's Public Schools
http://www.doe.state.in.us/standards/welcome.html

Content Standards and the Project Lead The Way program
http://www.pltw.org/aindex.htm

Standards related to Computers and Instructional Technology
http://cnets.iste.org/

Technology For All Americans (TFAA) Project
http://www.iteawww.org/TAA/TAA.html

The National Academies (engineering, technology, etc.)
http://www.nationalacademies.org/

Instructional Resources

The following textbooks, reference materials, and resources are helpful when preparing to implement this communication–based course . . . . .

Brain, M. (1990). How stuff works. New York: Hungry Minds.

Buchanan, M. (2002). Nexus: Small worlds and the groundbreaking science of networks. New York, NY: W.W. Norton & Co.

Burke. (1985). The day the universe changed. Boston, MA: Little, Brown, & Co.

Cyganski, D. & Orr, J.A.. (2001). Information technology: Inside and outside. Upper Saddle River, NJ: Prentice Hall.

Fountain (ed.). (2001). Circuits: How electronic things work. New York, NY: The New York Times.

Friedman, T.L. (2005). The world is flat: A brief history of the twenty-first century. New York, NY: Farrar, Straus, & Giroux.

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